A DECOMPOSITION ARCHITECTURE FOR AN MCU

RELATED APPLICATIONS

This application is a continuation-in-part of United States Patent Application Serial Number 09/708,898, filed November 8, 2000, the contents of which are incorporated herein by reference. The present application further claims the benefit of priority from United States Provisional Application Serial No. 60/164,298 filed November 08, 1999, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

This invention relates generally to multimedia communications, and more specifically, to a system and method for decomposing a multipoint multimedia communication system to control unit and process unit.

BACKGROUND

As the geographical domain in which companies conduct business continues to expand, the traffic of multimedia teleconferencing overloads multimedia communication central nodes. In the current market, most multipoint multimedia calls are scheduled in advance through companies that own multipoint control units (MCUs). An MCU provides the capability for three or more terminals and gateways to participate in a multipoint conference. If a company owns more than one MCU, it has more flexibility in hosting multimedia conferences. However, each MCU must be operated independently from the other MCUs in setting up and controlling multimedia conferences. Additionally, the capacity of each MCU is limited to multimedia conferences controlled by the corresponding MCU. Because each MCU is a single entity that handles both the call signaling and the media processing of the conference, the resources of the multiple MCUs cannot be combined to promote more efficient scheduling.

As the business of multimedia conferences continues to expand, more and more standards have been written for multimedia conferences, such as H.320, H.321, H.324, and H.323 SIP. Those standards handle the call signaling and call control differently, yet use the same multimedia data standards such as H.261, H.263, MPEG, G.711, and T.120. The increasing number of multimedia conferences and standards drive the need for an MCU technology that is able to operate efficiently in a site utilizing a plurality of MCUs, which may share resources in order to increase the amount of traffic via the site. Furthermore, there is a need for technology easily adaptable to varying standards and increasing capacity.

The ITU and the IETF have defined decomposition architecture for a multimedia gateway, which comprises of a multimedia gateway control unit (MGC), a multimedia process unit (MG), and the intermediary communication protocol, Megaco/H.248. The MCU, as defined in the H.323 standard, comprises of a multipoint control unit (MC) and a multipoint processor (MP). The MC is an H.323 entity on the network that provides the control of three or more terminals participating in a multipoint conference. The MC may also connect two terminals in a point-to-point conference, which may later develop into a multipoint conference. The MC provides capability negotiation with all terminals to achieve common levels of communications, and may also control conference resources. However, the MC does not perform mixing or switching of audio, video and data.

The Multipoint Processor (MP) is an H.323 entity on the network providing the centralized processing of audio, video, and/or data streams in a multipoint conference. The MP provides the mixing, switching, or other processing of media streams under the control of the MC. The MP may process a single media stream or multiple media streams depending on the type of conference supported. The ITU has not defined the communication protocol between those two units in H.323, or a Decomposition MCU (DMCU) for other standards then H.323. One difficulty in operating the DMCU with other standards, such as H.320, is that signaling, control and media are multiplexed.

The decomposition architecture offers better utilization of resources, for one MC can control plurality of MPs, and a conference can share resources in a plurality of units etc. Also, an operator can upgrade its site by adding the appropriate units MP or MC according to it's the operator's needs. Those units can be from different vendors. In case of new versions or new standards the operator can update only the relevant unit MP or MC.

The MC functionality can be part of a general Media Gateway Controller (MGC). The MC can be considered as an MGC. Therefore, it is evident that there is a need for a DMCU that can work with plurality of endpoints supporting different standards.

SUMMARY OF THE INVENTION

The present invention provides a general DMCU that is not limited to H.323 and can also work for other standards like but not limited to H.320; H.321; H.324; and SIP. The DMCU comprises of a MC and a MP. The MC handles the call signaling and control while the MP handles the media streams. In cases where signaling, control and media are multiplexed (H.320; H.321 etc.) the MP will demultiplex/multiplex the streams and then uses signaling, tunneling or backhauling to send and receive control or signaling messages to and from the MC. The DMCU will address the different conferencing models as described in H.323, including centralized, decentralized and hybrid multipoint conference. In the case of decentralized or hybrid conference, a virtual MP may exist, even as part of the MC, and will support the media handling for the MC. In centralized conference all participating terminals communicate in a point-to-point fashion with an MCU. The terminals transmit their control, audio, video, and/or data streams to the MCU. The MC within the MCU centrally manages the conference. The MP within the MCU processes the audio, video, and/or data streams and returns the processed streams to each terminal.

A decentralized multipoint conference is one in which the participating terminals multicast their audio and video to all other participating terminals. The terminals are responsible for:

a)   summing the received audio streams; and

b)   selecting one or more of the received video streams for display. No audio or video MP is required in this case. The terminals communicate on their H.225, RAS and H.245 Control Channels with an MC that manages the conference. The data stream is still centrally processed by the MCU.

There are two types of hybrid multipoint conferences. A hybrid multipoint centralized audio conference is one in which terminals multicast their video to other participating terminals and unicast their audio to the MP for mixing. The MP returns a mixed audio stream to each terminal. A hybrid multipoint centralized video conference is one in which terminals multicast their audio to other participating terminals and unicast their video to the MP for switching or mixing. The MP returns a video stream to each terminal.

According to H.248, the logical entities in MP that can be controlled by the MC include terminations and contexts. A termination is a logical entity on a MP that sources and/or sinks media and/or control streams. A termination is described by a number of characterizing properties, which are grouped in a set of descriptors that are included in commands. A descriptor is a syntactic element that groups related properties. For instance, the properties of a media flow on the MP can be set by the MC by including the appropriate descriptor in a command. Terminations have unique identities (termination IDs), assigned by the MP manager at the time of their creation.

Terminations representing physical entities have a semi-permanent existence. For example, a termination representing a TDM channel might exist for as long as it is provisioned in the DMCU. Terminations representing ephemeral information flows, such as RTP flows, would usually exist only for the duration of their use. Ephemeral terminations are created by means of an Add command. They are destroyed by means of a Subtract command. In contrast, when a physical termination is added to or subtracted from a context, it is taken from or to the null Context, respectively.

Terminations may have signals applied to them. Signals are MP generated media streams such as tones and announcements. Terminations may be programmed to detect Events, the occurrence of which can trigger notification messages to the MC, or action by the MP. Statistics may be accumulated on a termination. Statistics are reported to the MC upon request (by means of the AuditValue command,) and when the termination is removed from a call.

The protocol between the two units, MC and MP, can be used to create new terminations and to modify property values of existing terminations. These modifications include the possibility of adding or removing events and/or signals. An MC can only release/modify terminations and the resources that the termination represents that it has previously seized via, e.g., the Add command. Example terminations include MUX/DEMUX, ISDN ports, and audio mixers.

A context is an association between numbers of terminations. The context can describe the topology (who hears/sees whom) and the media mixing and/or switching parameters if more than two terminations are involved in the association. A special context called the *null* context contains terminations that are not associated to any other termination. Terminations in the null context can have their parameters examined or modified, and may have events detected on them.

In general, an Add command is used to add terminations to contexts. If the MC does not specify an existing context to which the termination is to be added, the MP creates a new context. A termination may be removed from a context with a subtract command, and a termination may be moved from one context to another with a Move command. A termination SHALL exist in only one context at a time. The maximum number of terminations in a context is an MP property. DMCU that support multipoint conferences might allow three or more terminations per context.

The attributes of contexts are ContextID and the topology (who hears/sees whom). An exemplary context can be a videoconference of 3 participants: one is using an H.323 endpoint and two are using H.320 endpoint with bit rate that is different from the first one. This context includes the following terminations: three networks I/F ports, one RTP, two MUXes, an audio mixer and a video mixer. The present invention implements a DMCU by using the connection model and protocol that is described in H.248. The present invention allows communication and resources sharing between plurality of MCs and MPs.

The MC <u>includes</u> the part of the call state that handles the call signaling and call control of the MPs that are connected to it. The MC can be a software program residing in a General Media Gateway controller. Other objects, features, and advantages of the present invention will become apparent upon reading the following detailed description of the embodiments of the invention, when taken in conjunction with the accompanying drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a system diagram that illustrates an exemplary operator site implementing various embodiments of the present invention.

Fig. 2 is a system diagram that illustrates another exemplary operator site.

Fig. 3 is a functional block diagram of an exemplary MC.

Fig. 4 is a functional block diagram of an exemplary MP.

Fig. 5 is a functional block diagram of an exemplary context.

Fig. 6 is a flow diagram illustrating the steps involved in an exemplary embodiment of the present invention during the conference.

DETAILED DESCRIPTION

Referring now to the drawings, in which like numerals refer to like parts throughout the several views, exemplary embodiments of the present invention are described.

Fig. 1 is a system diagram that illustrates an exemplary operator site **100** implementing various embodiments of the present invention. The site **100** may include one or more DMCUs: **(110a; 120a); (110b; 120b)** and **(110c; 120c)**. An exemplary DMCU comprises of one MC **(110a; 110b; 110c)** and one MP **(120a; 120b; 120c)** respectively. Although three DMCUs are illustrated, the present invention is not limited to a particular number of DMCUs and the presented configuration is intended to be illustrative of an exemplary configuration. An MC can control one or more MPs. The connection between the MC and MP that compose a DMCU is based on H.248/Megaco over IP it may be over an Intranet **130**, Internet LAN, or direct connection. The MCs and the MPs may be co-located or geographically dispersed.

In an exemplary system, each DMCU supports connections with various types of terminals (not shown) including, but not limited to, H.321 H.324 and H.320 terminals. Those terminals are connected to Switched Circuit Networks (SCN) **140** like but not limited to PSTN and ISDN. The exemplary system **100** also supports H.323 and SIP terminals (not shown) that are connected to packet switch network **150**, including but not limited to, local area networks, the Internet or an Intranet. The connections to the terminals are illustrated as network clouds **(140 and 150)**. Connection cloud **140** is connected to the MCs via signaling and control line **143** and to the MPs via the media line **147**. Connection cloud **150** is connected to the MCs via signaling and control line **153** and to the MPs via the media line **157**.

Lines **143** and **153** represent an exemplary functional architecture of signaling and control connection. The signaling and control can also be physically connected to the MP. The MP transfers those signals via tunneling or backhaul to the appropriate MC. Those skilled in the art will appreciate that other terminal protocols and other networks could be used in alternative embodiments.

A terminal is an endpoint on a network, capable of providing real-time, two-way multimedia communication; audio and/or visual communication and/or data with other terminals or an MCU. The information communicated between the terminals and/or the MCU includes, but is not limited to, control signals, indicators, audio, moving color video

pictures and data. A terminal may provide speech only, speech and data, speech and video, or speech, data and video. In another exemplary configuration of a DMCU an MC may control more than one MP via the same IP network **130**.

Fig. 2 is a system diagram that illustrates another exemplary operator site **1000** that using another exemplary configuration of a DMCU, in which more than one MC, via the same IP network, **130** may control a single MP. In this configuration each physical MP (**120a; 120b; 120c**) may be divided into several logical MPs. For instance MP **120a** may be divided into Logical MPs **120aa; 120ab** and **120ac** and a different MC (**110a; 110b; 110c**) may control each logical MP respectively. For example, MC **110b** controls Logical MP **120ab**.

Another exemplary configuration of a DMCU (not shown in the drawings) utilizes the architecture of a Virtual MCU (VMCU). In this configuration one of the MCs becomes a Decomposed VMCU (DVMCU) and uses similar methods to control the other MCs and MPs as the methods that the VMCU uses to control the MCUs. The communication between the DVMCU the MPs and the other MCs is done over an IP network. Those skilled in the art will appreciate that an operator site may comprise of any of the above configurations of a DMCU or any combination of those configurations.

Fig. 3 is a functional block diagram of an exemplary MC **110**. The MC **110** is a platform independent system solution for controlling one or more MPs (**120a, 120b, 120c**). The MC may be a physical unit or a software program residing in a Media Gateway Controller (MGC) or a software program residing in a conventional MCU.

In an exemplary embodiment of the present invention, the MC **110** includes several modules that are controlled by an MC Management Module (MMM) **330**. The modules that the MC includes, like but are not limited to: SS7 Module **310**; H.225, H.245 & RAS Module **320**; H.323 Stack **325**; SIP Module and stack **345**; Conference Management Module (CMM) **335** and H.248 Module **340**. The CMM **335** may be a part of the MC or it can be an external module that resides in an external general computer system.

The MC **110** is connected, in both directions, to the H.225; H.245 & RAS Module **320**; SIP Module **345** H.248 Module **340** and the SS7 Module **310**. The MC communicates with H.323 Endpoint , which are connected to Packet switched network via H.225; H.245 & RAS Module **320**. Said module **320** comprises of three sub modules for processing the H.323 components: H.225 sub module which processes the call signaling, H.245 which

processes the call control information and the RAS sub module for processing the registration, admission and status component. The information is then processed by the H.323 Stack **325** and the processed information is transferred to the MMM **330**. Each MC may include plurality of H.225; H.245 & RAS Modules **320** one per each switched packet networks that the MC is connected to.

The MC communicates with SIP endpoints, which are connected to the packet switch network via the SIP module **345** for call signaling and call control. The information is processed by the SIP stack and is transferred to MMM **330**. Users, which are connected over SCN, communicate with the MC **110** via the MP **120** or via Signaling Gateway **160** through additional H.248 Module **142** or via a signaling protocol like SS7 through SS7 Module **310**. In communication with endpoints, which use such as like H.320, H.321, and H.324, the MP **120** MUX/DEMUX, the signaling and control components from the multiplexed stream, transcode them into H.248/Megaco protocol and transfer them to the MC **110** via H.248 Module **340**. The SS7 module 310 conveys the Non-Facility Associated Signaling (NFAS) SCN signaling to the MMM **330**. This module provides the flexibility to conserve SS7 code points and allows the SS7 switch to serve multiple DMCUs.

The MMM **330** manages the resources (terminations) of the MPs **120** that are controlled by the MC **110** and the events that occur. The MMM **330** may use an internal or external CMM **335** which comprises a plurality of multimedia conferencing management tools including but not limited to a conference reservation manager, a conference manager, a reports manager, a system administrator tool, and databases.

The CMM **335** is connected to the external world via an IP connection **350**. The external connection enables management communication with the customers, including but not limited to, conference reservation and requests for reports. The CMM **335** acts as the interface between the customer and the MC and manages the conference reservations and reports while the MMM **330** controls the ongoing conferences (contexts).

The Conferences Reservation Manager accepts requests for multimedia session reservations via an IP connection **350** and uses the reservation parameters to verify that it can be accepted. The reservation parameters include but are not limited to the number and types of terminals, line-speed, type of audio algorithm, start-time, end-time, video algorithm and the type of network. The Conferences Reservation Manager then stores the reservation record in the database. If the session has to start immediately, the Conferences Reservation Manager passes the information to the MMM **330**. The Conferences Manager starts a session when the

session's time to start arrives. The Conferences Manager loads the session onto the target MP via the MMM **330** and H.248 module **340** and gets status information from all of the MPs concerning ongoing sessions.

The Reporting Manager builds reports which may include length of time terminations were used, particular terminations used for a specific session, and percentage of terminations used during a specified time period. The reports are built upon the receipt of a report request from the site operator via an IP connection **350**. The System Administrator serves as an input tool for the MC parameters. The MC parameter may include, but are not limited to, the maximum number of MPs controlled by the MC, and neighbor MCs. In an exemplary embodiment of the present invention, the databases store data pertaining to reservations, users, and any other data required for the operation of the DMCU. The database can be an external database such as a database using LDAP or ILS.

The MMM **330** keeps the information concerning the MPs terminations i.e. audio terminations, video terminations, etc.   When the MMM **330** gets a request to initiate a conference from CMM **335** it allocates the appropriate terminations to a context that represents the requested conference.   An exemplary method for initiate a conference is describing below in conjunction with Figure 6.

The MMM **330**, based on the available terminations of an MP, also calculates terminations availability for future contexts reservations.   The MMM **330** may receive messages, such as call start and call terminate, from the MP and stores the messages in a database. The MMM **330** provides for capability negotiation with all terminals to achiever common levels of communications based on the signaling and controls signals that it receives from the various terminals and MPs via H.323 Stack **325** and/or H.248 Module **340** and with cooperation with CMM **335**. The MMM **330** may also control conference resources and may start and terminate the call signaling and control. The MMM **330** decides which MP **120** will handle a context (conference) and the terminations in said MP that will be in said context. Then MMM **330** manages the termination and streams in the context according to the current status of the conference.

Fig. 4 is a functional block diagram of an exemplary MP **120**. The MP **120** provides media processing, mixing, switching, transcoding or other processing of media streams (Audio, Video and Data) under the control of the MC. The MP may process a single media stream or multiple media streams depending on the type of conference supported.

In the cases where signaling, control and media are multiplexed (H.320; H.321 H.324 etc.) the MP will demultiplex the streams, and to transfer the call control and/or the call signaling messages to the MC 110, using signaling, tunneling or backhaul.

In an exemplary embodiment of the present invention, a functional MP 120 includes several modules, including but not limited to a plurality of switch packet network Interface (SPNI) 445; H.248 Module 447; SCN Interface 450 plurality of active context 410, and a Bank of Available Terminations (BOAT) 420. An MP Management Module (MPMM) 430 controls those modules. The BOAT 420 comprises of several groups of terminations 461 to 466, each group includes plurality of terminations from the same type. A termination can be a physical entity or a logical entity that is composed from physical entities allocated to said termination by the MPMM when the termination is added to a context.

Although three active contexts 410, three SCN Interfaces 450, three SPNI 445 and three terminations in a group are illustrated, the present invention is not limited to a particular number and the presented configuration is intended to be illustrative of an exemplary configuration.

Some of the units and terminations that compose the MP 120 are units that exist in a typical MCU such as Accord MGC 100. The DMCU manages those units in novel method. The unique modules of an MP are MPMM 430 and H.248 Module 340. The MP may be a physical unit or a software adaptation of a conventional MCU. The MP may be also a Software program running on a general computer.

The MP 120 receives and transmits operational control to and from the MC 110 via H.248 Module 447. Media communication with the users is done directly through the appropriate context 410. Detail description of an exemplary context is done below in reference to Fig. 5.

Although call set up, call control, call signaling and call management are done by the MC 110, the MP 120 can tunnel them between the SCN 140 or the packet switch network 150 users and the MC 110. The MP includes plurality of SCN Interface Modules 450. Each Module 450 accepts a SCN dial in number. In the event that one of the connections is involving in a current context then its SCN Interface Module 450 becomes a part of the context 410.

Bonding termination 462 handles the bonding of the N ISDN 64kbit channels to one call. More information about bonding can be found in standard ISO/IEC 13871 in website: www.iso.ch . H.221 MUX termination 463 is handling the multiplexing and demultiplex of

the H.221 stream, and receives the bit rate of the call, the structure of the H.221 stream and demultiplexes the stream to audio, video, data and control streams. The control information is transferred to MPMM **430** that may use part of the information and transfer the information, which is required by the MC **110**, to H.248 Module **447.**

H.248 Module **447** transmits this information to the appropriate MC using H.248/Megaco/IP protocol. The connection between the MP and the MC can be by direct connection or via IP network, such as Intranet, Internet; LAN etc. If an endpoint is already connected to an active conference via a context **410**, then the SCN Interface module **450** becomes part of said context **410** and transfers the video, audio and data to the appropriate video mixer termination **465**; audio mixer termination **464** and data termination **466,** which belong to the same context. The H.221 MUX **463** also handles H.221 channel association.

The media processing resources of an exemplary MP **120** includes Audio Mixer Terminations **464**; Video Mixer Terminations **465** and Data Terminations **466**. The Audio Terminations (AMT) **464** handles the audio mixing. The mixer will accept audio streams from all participants and will mix them. The mixing options will be either the N loudest speakers or N specific streams. The audio mixer signals the stream ID of the loudest speaker and the Ids of the mixed streams.

When an RTP or H.221 MUX termination is modified or added, the audio mixer is modified with the stream ID and the audio codec of the stream.

Video Mix Termination (VMT) **465** can be of one of four types, not shown in the drawing. Video switch termination is conducting a video switching conference. In this conference type, one of the incoming video streams is sent to all the other participants. The selected stream can be the video stream of the active speaker who will receive the previous speaker stream or the MC can decide the displayed stream for each participant. The voice activated switching can be managed automatically by the MPMM **430**, or by the MC **110**. In this type of conference all video streams have the same parameters (line rate, frame rate, algorithm).

Video mixing termination conducts a video mix session that mixes N out of M streams. The MC **110** defines the incoming stream IDs for the termination, the layout and if to switch the content of a window according to the active speaker and the selected streams (participants) to be mixed for each participant. The video stream parameters can be different for each stream. Video softmix termination is a video mix session that mixes 4 incoming streams that have the same parameters (example mixing four H.261 QCIF stream to one

H.261 CIF outgoing stream). Transcode termination is similar to video switch but the MC 110 defines the video mode of the termination and allows it to transcode video streams that have different parameters. In the event that the conference includes data the Data Termination (DT) **466** process the data protocols like T.120 etc. and transfers back the processed data .

The RTP Termination **461** handles the different media packet streams. It receives them from the SPNI **445** and separates them to four different streams as instructed by the MC. Control information, if received in the MP, is transferred to the **MC 110** via H.248 module **447**. Data is transferred to DT **466**, video is transferred to VMT **465**, and audio to AMT **464**. On the outgoing direction, it receives the streams from the DT **465**, VMT **466** and the AMT **464** and send them to the remote terminal. Stream synchronization like lip synch can be done in the RTP **461** or in the VMT **466** and AMT **464** according to MC commands. The physical unit of a termination like but not limited to an AMT **464**, a VMT **465**, a DT **466**, H.221 MUX **463**, and RTP Termination **461**, which may be a modified physical unit belonging to a common MCU or a common Audio Bridge, with some modifications such as the mapping of the physical unit into logical terminations.

There are several levels of control in managing Multimedia Multipoint Conferences. For example, the MC **110** interfaces with the client by accepting requests, making reservations, setting up calls, terminating calls. The MP **120** may be part of this activity, but as a channel between the MC and the customer.

The MC **110** also manages the resources of the MP **120**. The MC **110** selects the appropriate MP 120 and the appropriate type of terminations in said MP that will be involved in the conference, and also defines the type of conference and the streams that need to be present to the customer. The MPMM **430** receives the resource allocation, the type of conference and the streams that need to be present to the customer, from the MC **110**. Based on this information the MPMM **130** selects the exact physical resource. Then the MPMM **430** creates the terminations and the context according to the command from the MC **110**. The VMT **465**, the AMT, and the DT **466** handle the stream topology. The MPMM **430** transmits to the MC the ID number of the selected terminations and status and indications about the ongoing conferences.

Real time management: the MPMM **430** manages the conference context. The MPMM **430** creates a Virtual context Manager (VCM) per conference. The VCM manages the conference. It receives indications and statuses from the terminations. In case of a

conference that dynamically replaces speakers based on the loudest speaker the VCM changes the speaker based on the received indications.

Figure 5 is illustrating an exemplary context, Context N **410**. The context is an entity that has been generated by the DMCU for the period of the conference. It is initiated by the MC **110**, it is constructed by the MPMM **430** and its real time management is done by VCM **510**. At the end of the session the MC clears the context and returns the terminations of the context to BOAT **420**.

The exemplary context represents a conference of four endpoints with the following exemplary parameters. Endpoint 1 (EP1), not shown in the drawing, is connected to SCN **140** using H.320 protocol and video compression standard H.261. Endpoint 2 (EP2), not shown in the drawing, is connected to SCN **140** using H.320 protocol and video compression standard H.263. Endpoint 3 (EP3),not shown in the drawing, is connected to the Internet **150** with H.323 protocol and video compression standard H.263. Endpoint 4 (EP4),not shown in the drawing, is connected to the Internet **150** with H.323 protocol and video compression standard H.261.

The required properties for the conference are: All endpoints are Video Audio and Data Endpoints. The conference type Video Transcoding meaning that all the participant sees the current loudest speaker while the speaker sees the previous one and the video streams are transcoded to accommodate the different endpoints.

Based on the above needs the MC **110** request from the MP **120** to create a Context with the following terminations: two Bonding terminations **462**; two H.221 MUX terminations **463**; two RTP Terminations **461**; an AMT **464**; a VMT **465** and a DT **466**. The VMT will be of type Transcoding Video Termination.

The MPMM **430** selects the exact terminations from the BOAT **420** and defines the streams among those terminations. For the current example the MP selects and defines the following termination and connections:

An AMT **464f** is a common audio mixer that can mix the audio of at least four inputs. The AMT **464f** can analyze the inputs identify the loudest speaker and send indication about the Identification of the loudest one.

A VMT **465c** is a video transcoding unit it can be implemented by common transcoding methods like using four decoders, four encoders (one channel per each endpoint) and a shared video bus.

A DT **466** that can handles data protocols like T.120.

Two Bonding terminations **462a** and **462b**.

Two H.221 MUX terminations **463a** and **463b**.

And two RTP Terminations **461a** and **461b**.

The MPMM **430** defines the topology of the exemplary context as follow:

The media stream to and from EP1 is done via Bonding termination **462a** and H.221 MUX **463a**. From unit **463a** the Audio stream is transferred to the first channel of AMT **464f**. The video stream is transferred to Channel number 1 of VMT **465c**. The decoder and the encoder of channel 1 are adjusted to fit the needs of EP1. The output of the encoder of channel 1 is transferred to unit **463a**. The data is transferred to DT **466f**.

The media stream of EP2 is using similar path but via units **462b, 463b,** the second channel in AMT **464f** and the second channel of VMT **465c** respectively. The media stream to and from EP3 (not shown) is done via RTP Termination **461a**. From unit **461a** the Audio stream is transferred to the 3rd channel of AMT **464f**. The video stream is transferred to the 3rd Channel of VMT **465c**. The decoder and the encoder of channel 3 are adjusted to fit the needs of EP3. The output of the video encoder of channel 3 is transferred to unit **461a**. The data is transferred to DT **466f**.

The media stream of EP4 is using similar path but via units **461b**, the 4th channel in AMT **464f** and the 4th channel of VMT **465c** and the 4th channel of DT **466f** respectively. VCM **510** receives indications from all the units. Among these indications it gets indication from AMT **465f** about the loudest speaker. When the loudest speaker is changed the VCM **510** routes the output of the video encoder of the new loudest endpoint to the other three endpoints while the video to the new loudest speaker remains the same, (the video of the previous speaker).

The VCM **510** informs the MC about replacing the speaker as well as any other changes in the status of the conference. In another scenario the VCM **510** only informing the MC about the loudest speaker and the MC instruct the VCM **510** to change routing. The VCM is not changing the routing automatically,

Fig. 6 is a flow diagram illustrating the steps involved in an exemplary embodiment of the present invention during a conference. During the initiation step **610** the MP **120** connects to the MC and informs the MC **110** which termination it supports and what are the capacities and algorithms supported. This is done by sending a service change from the MP and the MC will do audit values. The MC **110** keeps track of all MPs connected to it and the capacity of each MP.

When the MC **110** receives from the Conferencing Service Manager, CMM **335**, the conference parameters (number of participants, dial out number etc.). In step **612** the MC creates the conference context on the MP **120**. The MC **110** adds in step **614** the selected type of video mixer and audio mixer terminations to the conference; the selected terminations fit the definitions of the conference. The MP based on this information creates in step **616** the context with the added terminations, (VMT, AMT and the DT), and allocates the needed MP physical resource. It returns the identifiers of the context and terminations to the MC and the MC registers the conference in its database.

Depending on the type of Endpoint, the MC allocates the resources that are related to the Endpoint. The MC starts a loop on all the Endpoints. In step **620** the MC checks the type of the Endpoint. If the endpoint is using protocol H.320 the MC moves to step **622** and adds H.221 MUX Termination **463** and in cases that it needs Bonding the MC adds also a Termination **462**.

The H.221 MUX Termination **463** or the Bonding termination **462**, if bonding is needed, dials the user and exchange capabilities, step **624**. The H.221 MUX Termination **463** updates the MC with the results of the negotiation. Another way to exchange parameters can be by the MC, which dials via a signaling gateway and using the SS7 Module **310**.

The MC exchange capabilities with the endpoint and establish the communication mode. In H.320 the H.221 MUX termination will do the actual protocol but the MC will do decisions. If the Endpoint is H.323 endpoint, the MC moves to step **626**, adds an RTP Termination **461** to the context on the MP **120**. The MP **120** sends the port ID number to the MC.

In step **628** the MC dials the user. The H.323 protocol stack is part of the MC and the MC exchanges capabilities with the endpoint. Based on the results of the capabilities negotiations the MC in step **630** decides on the conference mode and updates the Terminations in the context. The MC updates the RTP **461** or H.221 MUX Termination **463** and the video and audio mixer terminations with the right codec information.

The MC in step **632** instruct the MP to opens the channels for communication and returns to step **620** for the next Endpoint until the MC adds all the endpoints. During the conference both logical units, the MP **120** and the MC **110**, controls the conference. The MC in step **634** may receive H.245 commands or tunneled H.320 BAS commands that may affect the conference context. For example getting a video fast update command from the remote end may trigger a command to the video mixer termination. In parallel the MP, step **636**, in

the case of voice activated switching may switch active speaker and notify the MC about the switching, the MC decide which method to use. In step **640** the MC identifying the end of conference manages the conference tear down process. It will terminate calls delete the terminations and context.

In the description and claims of the present application, each of the verbs, "comprise" "include" and "have", and conjugates thereof, are used to indicate that the object or objects of the verb are not necessarily a complete listing of members, components, elements or parts of the subject or subjects of the verb.

The present invention has been described using detailed descriptions of embodiments thereof that are provided by way of example and are not intended to limit the scope of the invention. The described embodiments comprise different features, not all of which are required in all embodiments of the invention. Some embodiments of the present invention utilize only some of the features or possible combinations of the features. Variations of embodiments of the present invention that are described and embodiments of the present invention comprising different combinations of features noted in the described embodiments will occur to persons of the art. The scope of the invention is limited only by the following claims.